PATENT SPECIFICATION (11) 1 445 394

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(54) IMPROVEMENTS IN OR RELATING TO BOLTS

(71) We, INDUSTRIAL ACOUSTICS COMPANY, INC., a corporation organized and existing under the laws of the State of New York, United States of America, of 380 Southern Boulevard, Bronx, State of New York 10454, United States of America, (assignee of ARNE M. KAUFMAN), do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:

The present invention relates to threaded connecting devices, as exemplified by bolts and especially stud bolts, which incorporate a safety device to prevent a failure in service from the unintentional disengagement of the threads, such as the accidental unscrewing of a bolt.

Many structural arrangements had been proposed for preventing fastening or connecting devices from being dislodged or disconnected, especially by accident. Some of these, as exemplified by United States Patent Specifications Nos. 517,022 and 974,468, are directed at locking bolts with nuts having internal linear slots, and the latter may be of rather complicated construction.

Another group of locking devices is disclosed only in combination with smooth pins without any suggestion of how they might be adapted to bolts. Some of these constructions are obviously not suitable for use with a threaded member, and none of them suggest a latching member being recessed within the root diameter of the external or male thread.

Also, some rather complicated internal structures are involved in this group of patent specifications which include United States Patent Specifications Nos. 577,039, 1,349,344, 1,659,992, 1,805,138 and 3,055,015.

In general, practically all of these locking devices would require substantial modification before they could be used in a threaded application, and none are apparently suitable for use in a blind application where one cannot reach behind one of the members to be connected and fasten the connecting device behind it.

In another group comprising United States Patent Specifications Nos. 1,340,470, 2,698,552 and 3,208,329 are shown latching devices employed in conjunction with threaded connections, but none of the latches are intended to pass through a female-threaded member and lock against its rear or exit surface.

The present invention is directed at self-latching bolts, preferably stud bolts with a thread adjacent to each end, which are easy and inexpensive to fabricate by reason of their extremely simple structure. The latches on these bolts automatically engage female-threaded members after being passed therethrough; yet no modification of the female-threaded member is necessary. Moreover, such bolts can be installed in blind locations and even unscrewed from blind locations with a wrench.

According to the present invention there is provided a bolt adapted for rotary and self-latching engagement with a female-threaded member and comprising a shank having a corresponding male thread on at least part of its surface, a radially oriented longitudinal slot in said shank, a latching pawl retractably mounted in said slot, that end of said pawl which trails when the shank is being threaded through a said female-threaded member being adjacent to said male thread, a frangible pivot pin, sized to break at a predetermined load, pivoting said pawl to the bolt near that end of the pawl which leads when the shank is being threaded through said female-threaded member, and spring means urging the trailing end of said pawl substantially

radially outward whereby said trailing end of the pawl is extendable for latching engagement with the exit surface of the female-threaded member substantially immediately after said trailing end of the pawl has passed through said female-threaded member.

Preferably the pawl is retractable within said slot to a location entirely within the root diameter of the male thread whereby the bolt is free-running upon engaging the thread of a said female-threaded member. Preferably the maximum radial extension of the pawl for latching engagement is predetermined and restricted by contact of the leading end of the pawl with the bottom of the slot.

Preferably the slot intersects an end of the bolt. Preferably also the bottom of the slot adjacent the trailing end of the pawl is in the form of an arc in a longitudinal plane. Conveniently said spring means is a bow-shaped leaf spring retained in the slot by engaging a single notch in the internal edge of the pawl. The bolt can have a fixed head at one end thereof, or can be in the form of a stud bolt threaded at both ends when greater flexibility of adjustment is desired.

The invention will be described further, by way of example with reference to the accompanying drawings, in which:—

Fig. 1 is a sectional view, partly in elevation, of a stud bolt according to the invention partially threaded into a tapped hole in a box channel, and

Fig. 2 is a similar view showing the bolt fully installed with its latch engaging the interior surface of the channel.

Fig. 1 illustrates the act of threading a stud bolt 10 through a structural metal plate or a board 12 to fasten it to a closed box channel 14. A shank 16 of the stud bolt 10 has a male screw thread at its ends 18 and 20, and the lower end 20 engages the corresponding female thread in a tapped hole 22 in the wall of channel 14 while the bolt 10 is being installed through the aperture 24 in the plate 12. At this stage, a pawl 26 of approximately 1/8 inch thickness is retracted completely into a longitudinal slot 28 with a shoulder 30 of the pawl bearing on the bottom 31 of the slot near the trailing end thereof.

The slot 28 is longitudinally and radially oriented with the axis of the bolt 10, and it may be about 5/32 inch wide in the case of a bolt 3/4 inch in diameter. It will be noted that the trailing end of the bottom 31 of the slot in the longitudinal reference plane is in the form of an arc of a circle which corresponds with the diameter of the milling tool used in making the slot in a very simple milling operation. The slot 28 deepens toward the outer (lower) end of the bolt 10, and that lower portion 52 of the bottom 31 of the slot may be a straight line depending on the diameter of the milling cutter. It is preferable to avoid having the slot extend entirely through the diameter of the bolt in order to preserve essentially all of the strength of the bolt at the point of the threaded engagement when the installation of the bolt is completed. At the moment, the latching pawl is housed in the fully retracted position with its entire body, including the lower edge 32 of the pawl, incorporated wholly within the root diameter of the male thread 20 by reason of its configuration and mounting upon a frangible pivot pin 33; the engagement of the threads presses the pawl 26 back into the slot against the action of a bent leaf spring 34 which is retained in place by a notch 36 in the internal edge of pawl 26. Spring 34 may be described as having the shape of a bow or partial U-bend.

To obtain a snug fit as described hereinafter, a stud bolt is often preferred for fastening structural elements together, and this may be secured with a slotted nut 38 which may be locked upon the upper thread 18 by means of the inwardly directed tab ends of a semicircular locking spring 40 with the tab ends extending through diametrically opposed slots 42 and into the ends of one of the holes 44 drilled transversely through the bolt. This nut 36 when locked may be used to turn the bolt into and through its threaded engagement, or one may slip a pin through one of the holes 44 to provide a good grip for turning the bolt.

Fig. 2 shows the bolt installed with the latching pawl 26 fully extended by the pressure of spring 34 which occurs immediately after the trailing end 46 of the pawl has advanced below the inner face of the top wall of box channel 14. Thus, as soon as the trailing end 46 of the pawl is free of the female thread 22, it springs radially outward into engagement with the exit surface 48 on the inner side of the channel. This latching action can serve as a useful gauge to ascertain when the bolt is properly installed in a blind location, such as box column 14, as one may test at every turn or fractional turn by turning the bolt backward slightly to find out the moment that the latching pawl is engaged and locks the bolt against withdrawal. When the pawl is pushed out by the spring 34 its movement is checked by a shoulder 50 of the pawl coming to rest against the lower end 52 of the longitudinal slot.

After the pawl is in latching engagement, the nut 38 is turned down on the thread 18 with appropriate force, and the locking spring 40 is again inserted to lock the nut in position after it has brought the plate or

board 12 snugly against the exterior of the box channel 14.

The present bolt may thus be easily installed in a blind location. To remove it from such a location involves the breaking off of the pawl by applying a relatively heavy torque with a wrench of moderate length on a fixed bolt head or nut 38, or one may use a pipe wrench on the threads 18 or the unthreaded section 16 of bolt 10. The latched pawl 26 is capable of locking the bolt against backing off or becoming unscrewed under vibration or a moderate torque, but the hollow pivot pin 33 and the pawl are sized to break off under the higher torque of a wrench.

In other locations, where one can reach the latching pawl, the bolt may be readily unscrewed by hand or a very light torque after the corner 46 of the latching pawl has been pushed back beneath the threads 20 by hand when it is clear of the surface 48 and below threads 22.

The many advantages and benefits derived from the construction of the bolt, especially from a standpoint of economical and simple manufacture are apparent. In order to have the desired free-running quality, the pivot pin 33 should be located near the leading end of the latching pawl 26, or at least, beyond its midpoint; also, the entire pawl must lie within the root diameter of the bolt when the pawl is fully housed. Bolts with a variety of fixed heads may be used instead of that shown, and the female-threaded member may be a conventional nut.

It is also advantageous that no modification of ordinary nuts or fixtures topped with female threads is required for use with the present bolts as long as the bolts can extend beyond an exit surface.

WHAT WE CLAIM IS: —

1. A bolt adapted for rotary and self-latching engagement with a female-threaded member, comprising a bolt shank having a corresponding male thread on at least part of its surface, a radially oriented longitudinal slot in said shank, a latching pawl retractably mounted in said slot, that end of said pawl which trails when the shank is being threaded through a said female-threaded member being adjacent to said male thread, a frangible pivot pin, sized to break at a predetermined load, pivoting to the bolt near that end of the pawl which leads when the shank is being threaded through said female-threaded member, and spring means urging the trailing end of said pawl substantially radially outward whereby said trailing end of the pawl is extendable for latching engagement with the exit: surface of the female-threaded member substantially immediately after said trailing end of the pawl has passed through said female-threaded member.

2. A bolt as claimed in claim 1, in the form of a stud bolt with a thread adjacent each end of the bolt.

3. A bolt as claimed in claim 1, having a fixed head at one end located at a predetermined distance from said trailing end of the pawl.

4. A bolt as claimed in claim 1, 2 or 3, in which said pawl is retractable within said slot to a location entirely within the root diameter of said male thread whereby said bolt is free-running upon engaging the thread of said female-threaded member.

5. A bolt as claimed in claim 1, 2, 3 or 4, in which the maximum radial extension of said pawl for latching engagement is predetermined and restricted by contact of the leading end of said pawl with the bottom of said slot.

6. A bolt as claimed in any preceding claim, in which said spring means is a bow-shaped leaf spring retained in said slot by engaging a single notch in the internal edge of said pawl.

7. A bolt as claimed in any preceding claim, in which said slot intersects an end of said bolt.

8. A bolt as claimed in any preceding claim, in which the bottom of the slot adjacent the trailing end of the pawl is in the form of an arc in a longitudinal plane.

9. A bolt constructed and arranged and adapted to be operated substantially as hereinbefore particularly described with reference to and as illustrated in the accompanying drawings.

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1445394 COMPLETE SPECIFICATION
1 SHEET *This drawing is a reproduction of the Original on a reduced scale*

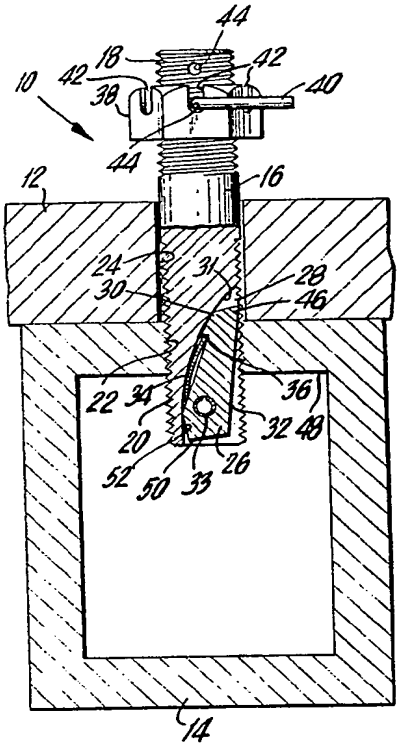

FIG.1

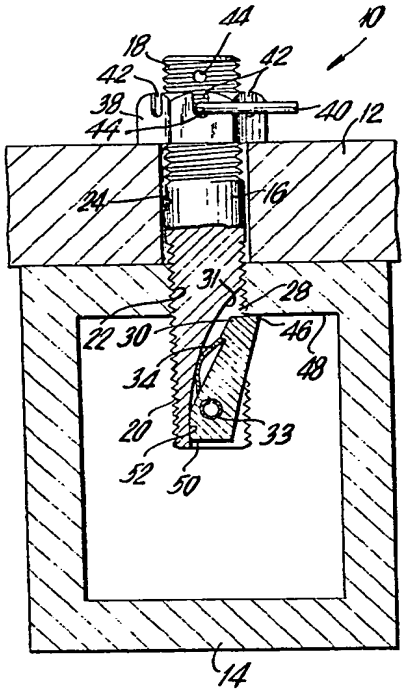

FIG.2